



Agricultural Policy Research in Africa



TRACTORS IN AFRICA: LOOKING BEHIND THE TECHNICAL FIX

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ACRONYMS

ACET	African Centre for Economic Transformation
AGCO	formerly known as Allis-Gleaner Corporation, currently known as AGCO
AGRA	Alliance for a Green Revolution in Africa
AMSEC	Agricultural Mechanisation Service Centre (Ghana)
APRA	Agricultural Policy Research in Africa
AU	African Union
AUC	African Union Commission
CEMA	European Committee of Associations of Manufacturers of Agricultural Machinery
CIMMYT	International Maize and Wheat Improvement Center
CSA	Agricultural Service Centre (Mozambique)
FAO	Food and Agricultural Organization of the United Nations
HP	horsepower
IFPRI	International Food Policy Research Institute
MFI	More Food International
MF	Massey Ferguson
SAM	Sustainable Agricultural Mechanisation
SAMA	Sustainable Agricultural Mechanisation in Africa
SIMA	Paris International Agribusiness Show
SSA	sub-Saharan Africa
SSC	South-South cooperation
UNECA	United Nations Economic Commission for Africa

CONTENTS

Summary	5
1. Introduction.....	6
2. The return of mechanisation in Africa	8
3. Brief overview of Africa’s agricultural mechanisation and tractorisation history	9
4. Recurrent debates on mechanisation and the missing politics.....	11
4.1 Induced innovation.....	11
4.2 Small and appropriate technology.....	11
4.3 Sustainable mechanisation.....	12
4.4 The role of the state	12
4.5 The overlooked politics	13
5 Mechanisation in the new international development landscape	15
5.1 FAO’s advocacy on Africa’s mechanisation.....	15
5.2 Southern solutions to Southern problems	16
5.3 Northern corporations with ‘sustainable’ solutions	16
6 Conclusion	19

List of figures

Figure 1 Imported tractors in Africa, 1980–2007

SUMMARY



This paper considers the current policy debate on agricultural mechanisation in Africa, situating this in the context of long-standing disputes on appropriate technology and roles for the state. Present calls for mechanisation, and tractorisation in particular, by national governments and international development agencies emerge in a different context, where there are new sources of technology and where development discourse emphasises sustainability and the role of the private sector. Yet, as before, recipes for agricultural mechanisation remain contentious and alliances between aid and business are once again driving policy. This time, however, Southern powers like China, India and Brazil are competing for space. This paper highlights the contentious nature of mechanisation in scholarly debate, policymaking and international development cooperation between North and South.

1. INTRODUCTION

Agriculture can power Africa's economic transformation, and for that to happen small-scale subsistence farmers need to be made commercially viable – so concluded a study by the Ghana-based African Centre for Economic Transformation (ACET 2017). The transformation of subsistence farmers into commercial entrepreneurs, the report suggested, entails embracing green revolution technologies – a combination of improved seeds, chemicals and mechanisation, including drones and tractors (ibid). In the same vein, the African Union (AU) Commissioner for Rural Economy and Agriculture, noted at the launch of its new agricultural mechanisation framework for Africa that “doubling agricultural productivity and eliminating hunger and malnutrition in Africa by 2025 will be no more than a mirage unless mechanisation is accorded utmost importance” (FAO and AUC 2018: vii).

This paper analyses the upsurge of enthusiasm with agricultural mechanisation, and tractors specifically, in Africa in recent years. Revisiting history, it takes notice of recurrent debates about suitable technology options and roles for the state, which now take place within a new context for international development. The latter is permeated by narratives about economic transformation and sustainability and influenced by the assertion of South-South cooperation (SSC) and technology trade within the global South. The paper contextualises and unpacks this renewed interest by governments, donors and cooperation partners (North and South), and international and pan-African organisations in mechanisation. It highlights the complex nature and political character of mechanisation that are overlooked by analyses focused solely on technical suitability and the economic rationale for the adoption of mechanical technology.

The historical review starts in the days of post-colonial enthusiasm about the role that mechanised agriculture could play in nation-building. It crosses the times of widespread disenchantment about state-led mechanisation programmes, in the mid-to-late 1990s, to arrive at the current moment of mechanisation revivalism. Present calls for mechanisation by

national governments, pan-African agencies and international development organisations are situated in a different context for international development, where new sources of development cooperation and mechanical technology have emerged and where the development discourse has new emphases. Yet, as before, the case for agricultural mechanisation and tractors in Africa remains disputed and alliances between aid and business are once again driving policy. This time, however, Southern players like China, India and Brazil are competing for space. This paper looks at mechanisation as a lens through which to explore intellectual dissonance in agricultural policy analysis, and to understand the competition for ideas on agricultural development as well as markets for technology.

The paper is part of a policy study on agricultural mechanisation that is set within the Agricultural Policy Research in Africa (APRA) programme on agricultural commercialisation, women's empowerment and poverty reduction. In addition to this paper's focus on the broader politics of mechanisation, the policy study also looks at the experiences with mechanisation in three selected countries – Ghana, Mozambique and Zimbabwe – all of which have been recently supported by SSC with Brazil, China and India. While the country cases undertake an in-depth analysis of the mechanisation trajectories of the three African countries and their domestic political economy (Amanor forthcoming; Cabral 2019; Shonhe 2019), this paper takes a broader view of the history of mechanisation in Africa and its recurrent debates, and situates the return to tractors in the context of the new aid-business nexus.

The analysis draws on secondary sources and on participant observation and informal interviews conducted at two events on agricultural mechanisation in Africa. One was the African Summit on 'Agricultural Mechanisation in Africa: What Strategy for Progress', organised by Axema (an association of French agricultural equipment companies) as part of the 2017 Paris International Agribusiness Show (SIMA). The other was the conference 'South-South Knowledge Sharing on Agricultural Mechanization', hosted by the

International Food Policy Research Institute (IFPRI), the International Maize and Wheat Improvement Center (CIMMYT) and the Ethiopian Agricultural Mechanization Forum, in Addis Ababa in November 2017.

Following this introduction, the paper has five additional sections. Section 2 illustrates the renewed interest in mechanisation in the light of recent developments in agricultural policy, aid and trade in Africa. Section 3 situates these developments in Africa's post-colonial history and section 4 reviews recurring themes and disputes in scholarly and policy debates about mechanisation. This is followed, in section 5, by an analysis of how agricultural mechanisation in Africa is shaped by the current aid-business environment. This considers the dominant actors, agendas and narratives in the new geopolitics of international development. Section 6 concludes.

2. THE RETURN OF MECHANISATION IN AFRICA

Agricultural mechanisation is back in the spotlight in Africa, following the re-emergence of agriculture in the policy agenda since the turn of the century. National governments and development agencies have grown interested once again in mechanisation, and this fits with a vision for agriculture centred on modernisation and increasing the sector's productivity and market competitiveness. Organisations such as the AU, the African Development Bank, the United Nations Economic Commission for Africa (UNECA) and the Food and Agriculture Organisation (FAO) have explicitly renewed their commitment towards mechanisation as part of their support for Africa's agricultural transformation (African Development Bank 2016; Ahmed 2015; FAO and AUC 2018).

The renewed policy interest in mechanisation parallels a rise in the import of agricultural machinery since the mid-2000s. Data on tractor imports illustrates the surge, as well as the historical recurrence of agricultural mechanisation in Africa's post-colonial period (Figure 1).ⁱⁱ

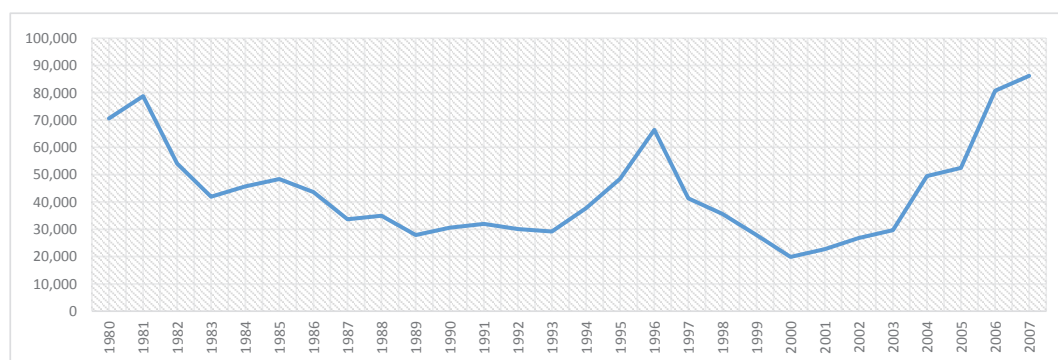
As in the past, national governments are once again playing a leading role in promoting mechanisation, this time assisted by subsidised export credits provided by countries like Brazil, China and India (Cabral, Favareto, Mukwereza and Amanor 2016; Diao, Cossar, Houssou and Kolavalli 2014). In 2010, for example, Brazil launched More Food International (MFI), an SSC programme offering a concessional loan of US\$640 million to five African countries (Ghana, Kenya, Mozambique, Senegal and Zimbabwe). The aim of

the programme was to support African small-scale farmers in accessing Brazilian farming machinery and thereby contribute to increasing food production and addressing national food security (Patriota and Pierri 2013). India and China have had similar credit lines in place (Diao et al. 2014: 169).

Tractors quickly became prominent in these South-South transactions. By mid-2015, the Brazilian MFI had supplied a first batch of 344 tractors to Zimbabwe (Mukwereza 2015), 430 to Mozambique (Notícias Online 2015) and Ghana had requested 1,000 units (ABIMAQ 2014). These were mostly four-wheel tractors, with power ranging from 50 to 90 horsepower (HP), despite the availability of smaller-scale machinery in the MFI menu. Brazilian tractors added to the tractors sold by India and China. In Ghana, between 2007 and 2008, 500 tractors were procured by the government through a concessional loan provided by India (Diao et al. 2014: 178).

Africa's current mechanisation wave seems to be once again following the route of 'tractorisation' (Houmy, Clarke, Ashburner and Kienzle 2013), despite the widespread narrative of failure associate with state-led tractor schemes adopted in the past (Binswanger 1986; Binswanger and Pingali 1988; Mrema, Baker and Kahan 2008). Although in some cases the return of tractors is being driven by rising demand from farmers, as Diao et al. (2014) find in Ghana, in other cases it is being pushed by South-South aid and trade programmes and by national governments' modernisation ambitions (Cabral et al. 2016).

Figure 1. Imported tractors in Africa: 1980-2007 (quantity)



Source: Author's own, compiled from FAOSTAT 2018; Zimstats 2017; CIMMYT 2014

3. BRIEF OVERVIEW OF AFRICA'S AGRICULTURAL MECHANISATION AND TRACTORISATION HISTORY

Tractors have historically been the dominant form of mechanical technology promoted by the state in developing countries. Mrema et al. (2008) argue that this drew largely on the experiences of the United States and Western Europe, where tractors have long been a dominant form of farming technology. In the African context, the tractorisation of farming was promoted during the 1960s and 1970s as part of large-scale agricultural schemes that continued the trend of accumulation followed during colonial times, one which largely favoured settler farmers (Anthony 1988; Mrema et al. 2008; Wuyts 1981). Tractors were sold at subsidised prices to large-scale farmers, whereas hire services were developed to reach medium- and small-scale farmers and spread the fixed costs of tractors and associated equipment. In addition to these, public sector-funded schemes, such as cooperatives, communal farms, state farms and parastatals, were also introduced, all of which promoted large-scale mechanisation.

The option for tractors (and tillage) as the preferred form of mechanisation was not consensual in the early days of post-colonial history, and gave rise to heated debates on the suitability of tractor technology for agriculture in developing countries. Proponents of mechanically-powered technology and tractors (particularly in countries where the spread of *tse-tse* flies constrained animal draught) typically highlighted the ability of tractors to help in a number of ways, including: (i) expanding cultivation to hard soils and wasteland, as tractors could perform deep tillage; (ii) improving the timeliness of land preparation operations and thereby increasing productivity, especially for multiple sequential crops; (iii) overcoming shortages of labour and releasing labour for other activities; and (iv) reducing the drudgery of farming and improving farmers' working conditions (Mrema et al. 2008). Also, tractors could have multiple uses beyond tillage, including assisting in the construction of irrigation structures and the maintenance of rural roads, in the transportation of inputs and produce and in driving pumps and milling equipment (ibid).

Opponents to tractorisation, on the other hand, highlighted its impact on labour, employment and

wealth distribution in agrarian societies (Wuyts 1981). Others also noted the high costs (with imports, fuel and maintenance) associated with this form of mechanisation (Mrema et al. 2008). It was also argued that the small size and increasing fragmentation of farms made tractors inefficient. Improved hand tools and animal powered technology were more appropriate for small- and medium-scale farmers, and as a transitional step between human muscle-powered farming and reliance on tractors. In Mozambique's early days of socialism, a rift in economic policy ideas for agriculture pitted proponents of a Soviet-styled tractor-powered agriculture against those favouring a China-influenced, people-powered alternative (Ottaway 1978).

The criticism to mechanisation became stronger with the oil price crisis of the 1970s, which made tractors expensive to run, especially for small-scale farmers. The case against tractors was then strengthened by the poor performance of government-managed tractor schemes. Problems included: the lack of transparency and clientelism in the distribution of tractors; inefficiencies in public sector-run tractor hire services, including underutilisation due to limited capacity to operate machinery; and poor maintenance and repair services. Yet, proponents of tractorisation argued that the problem was not the tractors per se, as claimed by some of the critique, but the inadequacy of public policies to promote their use. The Chief Economist of the World Bank noted in 1967:

It is difficult to determine whether mechanization has failed because it was inherently uneconomic, or because it suffered from certain technical and managerial problems that could have been avoided or overcome. (de Wilde, cited by Mrema et al. 2008: 22)

Studies conducted in the 1970s and 1980s confirmed doubts about the suitability of tractorisation programmes.ⁱⁱⁱ A comparative analysis of the agricultural mechanisation experiences across developing countries concluded that productivity gains from tractors were not significant if not accompanied by increased use in other improved inputs, such as

seed and fertiliser (Binswanger 1986). It also indicated that mechanisation was most profitable where land was abundant and where labour was scarce relative to land, and was moving rapidly off the land. The damaging impact on employment was substantial where mechanisation was induced by public subsidies rather than driven by labour scarcity. Furthermore, subsidised mechanisation favoured larger farms and better-off regions (Sanders and Ruttan 1978).^{iv}

The mounting evidence on the insufficient contribution of large-scale mechanisation schemes to agricultural productivity discouraged donors to support these types of programmes (Anthony 1988). Although African governments remained interested in mechanical technology and in tractors particularly (Anthony 1988; Mrema et al. 2008), macroeconomic reforms under the Structural Adjustment package, of the Bretton Woods institutions, eventually forced the abandonment of these expensive, publicly-funded programmes (Houmy et al. 2013).

Attention then turned to small-scale mechanical technology options (such as small tractors) that were regarded as more appropriate for developing countries' contexts because of their affordability, their more suitable scale for small farms, and lower demands on skills and maintenance (Segal 1992). Small-scale mechanical technology had considerable impact in Asia (Biggs and Justice 2015). Bangladesh, for example, experienced significant rises in two-wheel

tractors from the late 1980s, when the government removed restrictions to machinery imports from China to make up for the severe losses in the draught oxen population following a major weather-based natural disaster (Biggs and Justice 2015; Diao et al. 2014).

In sub-Saharan Africa (SSA), however, small-scale technology remained confined to aid-sponsored pilot experiments (e.g. mini-tractors in Uganda and Swaziland) that were not successful with farmers and ended up being discontinued (Holtkamp 1990; Mrema et al. 2008). There were attempts to develop improved hand tools and animal-drawn implements but these also failed to be adopted by farmers at a significant scale. Therefore, in the SSA context, supply-led efforts to mechanise agriculture struggled continuously, irrespective of the type or scale of technology promoted (Pingali 1987). Despite this record, the case for promoting agricultural mechanisation is once again being made and this is part of a revival of agriculture in government policy, aid programmes, investments and trade.

The section that follows considers different perspectives on mechanisation and the dimensions emphasised in making the case for its reinvigoration. As in the past, concerns remain focused on the types of mechanical technology to prioritise and adequate policy fixes, whereas the political dimension of mechanisation and its historical role in processes of agrarian change tend to be overlooked.

4. RECURRENT DEBATES ON MECHANISATION AND THE MISSING POLITICS

Considerations about the technical and economic efficiency of machinery dominate studies and reviews of agricultural mechanisation experiences (Binswanger 1986; Binswanger and Pingali 1988; Diao et al. 2014). They ask questions about the types of technology that produce the highest yields, are affordable and financially viable for farmers at different scales. The failure of state-run programmes has been often highlighted and used to justify a more market-led approach (Daum and Birner 2017; Diao et al. 2014). The appropriate technology debate that emerged in the late 1980s added concerns about the social dimension of technology, highlighting issues of access and inclusion (Segal 1992; Stewart 1987). Over time, additional concerns with environment and soil conservation were also added, leading to the notion of sustainable mechanisation, that links sustainable intensification with conservation agriculture perspectives (Baudron et al. 2015; Houmy et al. 2013; Sims and Kienzle 2015a). Tractorisation was therefore criticised for putting at risk soil conservation, or for not being economically viable for small-scale farmers. In these debates, however, the political nature of mechanisation and the complex set of aims and intentions underpinning policy often went unnoticed. There are, however, some exceptions, as the latter part of this section will illustrate.

4.1 Induced innovation

Back in the 1980s, one of the arguments against mechanisation was that it was being pushed by governments without due attention to demand-side constraints. Labour in Africa was abundant, cheap and unskilled, and therefore the conditions were not in place to induce the adoption of labour-saving technology (Binswanger and Pingali 1988). Yet, some analysts have recently argued that changes in agrarian structures and systems, in some African countries at least, are leading to a rise in demand for mechanisation by farmers (Diao et al. 2014; Diao, Silver and Takeshima 2016). These changes include urbanisation and rising farm size and land concentration that increase land-to-labour ratios. Diao et al. (2014) argue that, in Ghana, demand for mechanised farming operations, particularly for

land preparation, has increased in recent years. This demand, they argue, comes not only from large- and medium-scale farmers but also from smallholders, who hire-in services from private tractor owners. Demand concentrates on tractorised ploughing and in regions of Ghana (Northern and Brong-Ahafo) where cereal production dominates and the land-labour ratio has been rising. Drawing on the induced innovation framework, this trend is then used to justify a market approach that ensures that farmers will naturally be induced to adopt technology when factor ratios and prices justify such choice. State interference, as this perspective goes, can distort these calculations and lead to the adoption of the wrong technology. Yet, this analysis has little to say about changing agrarian structures over the long run, and, as argued by Amanor (forthcoming), overlooks the fact that the conditions for the recent rise in demand for mechanisation have its roots in past state-sponsored mechanisation that cleared the land and reduced the cost of adopting mechanical technology today. Amanor also notes historical patterns of agrarian accumulation and change that have been shaped by aid-funded NGO interventions.

4.2 Small and appropriate technology

Where markets are poorly developed, demand is influenced by the type of machinery on offer. Would small farmers look for alternative forms if they knew about them and they were available? In Bangladesh, a market for small-scale machinery developed since the 1980s but only after the government promoted their use (by removing import tariffs) in response to a natural disaster that significantly reduced the oxen population (Biggs and Justice 2015; Biggs, Justice and Lewis 2011). In Tanzania, small-scale technology is starting to be adopted and two-wheel tractors (or power tillers) from China are becoming popular (Agyei-Holmes 2014). Despite being less robust than four-wheelers and having a relatively shorter lifespan, they are affordable and hence an attractive option for resource-constrained farmers. Ethiopia is also experiencing increases in imports of power tillers and in capacity to offer repair services for small engines (Baudron et al. 2015).

But state-driven mechanisation in Africa has been dominated by large and higher-powered machinery (Cabral et al. 2016). Östergaard (1989) argues that governments' involvement in selecting technology has historically led to the choice of inappropriately sophisticated machinery. And Biggs and Justice (2015: 31) note that the 'silent and hidden revolutions' of small-scale machinery experienced by South Asian countries is yet to arrive in Africa.

4.3 Sustainable mechanisation

In recent years, FAO has promoted the notion of sustainable agricultural mechanisation by highlighting social and environmental dimensions of mechanisation (FAO 2015; 2017). Its policy guidance to governments in SSA on how to prepare agricultural mechanisation strategies defines sustainable mechanisation as comprising three pillars: economic, social and environmental.

Policy analysis and design should therefore not only consider technical efficiency and affordability but also the social and environmental costs and benefits of mechanisation (Houmy et al. 2013). Mechanisation can produce positive social outcomes by reducing drudgery and promoting non-farm activities and employment opportunities (such as manufacturing, repair, and the provision of mechanisation services). It can also increase social and human capital by connecting farmers of different scales of production through networks of renting services that also become channels for sharing knowledge and experience, as suggested by the work of Cossar, Houssou and Asante-Addo (2016) in Ghana. Mechanisation can also safeguard the environment if, for example, reduced tillage machinery is used to protect soils from degradation.

The consideration of social and environmental criteria has led to the promotion of particular types of machinery that are thought to produce the best outcomes across the three sustainability pillars. Proponents of sustainable agricultural mechanisation emphasise the advantages of small-scale, low-cost and power-saving machinery and equipment that is compatible with conservation agriculture, such as power tillers and other small engines, as well as reduced tillage implements that can be used with power tillers and combined with animal draught. In FAO's own terms:

Promoting mechanization in agriculture means that more tasks can be completed at the right time, more efficiently and saving labour and energy. However,

the equipment has to be compatible with the social, economic and environmental conditions in which it will work, in order to achieve sustainable crop production intensification. One such example of this type of equipment that can easily adapt to the context of developing countries is the range of low-cost smaller horsepower tractors. This type of tractor can be attached to planters designed to operate on soils under zero tillage regimes by depositing seeds directly into the soil with minimal disturbance. (...) Low horsepower tractors, and indeed stationary engines, can also be used by smallholders to power other agricultural equipment, such as pumps, threshers and mills, improving farming conditions and productivity and coping with problems such as labour shortage and inadequate processing times. (FAO 2015: 6–9)

Yet, the adequacy of such solutions depends, amongst other things, on soil properties. For example, power tillers can only produce enough traction in wet paddy fields and are not a viable option for dry soils in rain-fed conditions (Baudron et al. 2015).

It is worth noting that there are arguments against mechanisation altogether, particularly from environmental and social welfare perspectives. As an external input-intensive intervention, mechanisation is outside the framework of 'agroecology' (Altieri and Farrell 1995). Furthermore, state-business alliances in agriculture have faced strong political resistance from opponents to what is regarded as a hegemonic project of modernisation favouring uneven patterns of accumulation in the countryside. These concerns underpin calls for 'shorthanded hoe-driven development', i.e. the rebuttal of mechanisation and modernisation of farming that is associated with land concentration, that have recently mobilised agrarian social movements in Mozambique (Santarelli 2015; Shankland and Gonçalves 2016).

4.4 The role of the state

The issue of what role the state should play in promoting mechanisation remains contentious. The recent revival in several African countries of direct state intervention in domestic markets for machinery, through imports and subsidised sales and hiring-out services, has been challenged by the arguments noted above that highlight market distortions and management inefficiencies (Diao et al. 2014; Houmy et al. 2013). Export credits provided by China, India, Brazil and others have allowed governments to have, once again, a direct stake in the import, selection and distribution of machinery. This is then either sold to farmers or hired-out through service

centres that governments across several countries have been setting up for that purpose, sometimes in partnership with private sector operators. In Ghana, about 90 Agricultural Mechanisation Service Centres (AMSECs) have been established since 2007, hiring out tractors and providing other services to farmers. In Mozambique, the government has established 96 Agricultural Service Centres (CSAs) across the country, some in partnership with private operators (FDA 2015).

The direct import of tractors by the government has been criticised for distorting markets and inhibiting imports of more suitable and affordable machinery by the private sector (Diao et al. 2014). Indeed, the Brazil-sponsored mechanisation programme MFI focused largely on tractors (and of one type), undermining the programme's initial focus on small-scale Mozambican farming (Cabral et al. 2016). The small-scale technology available under the Brazilian programme has been of little appeal to African governments (Cabral 2016a).

The model of state-subsidised service centres has also been criticised for failing to promote the use of machinery with sufficient intensity, increasing the financial burden of mechanisation on the government, distorting incentives for the development of a private market for machinery and encouraging rent-seeking behaviour (Diao et al. 2014).

Drawing on both historical records and some of the recent experiences, several authors have argued that governments should refrain from directly importing and selecting technology and focus instead on the regulatory framework and helping to address market failures (Diao et al. 2014; Houmy et al. 2013; Ströh de Martínez, Feddersen and Speicher 2016). One area where the role of the state is emphasised concerns the development of financial services (Ströh de Martínez et al. 2016). Smart subsidies have also been suggested for when the private sector is poorly developed and reluctant to invest in promoting particular technologies, such as small-scale and appropriate technology (Baudron et al. 2015).

Finally, the direct intervention by governments and the aid funding of mechanisation programmes has been criticised from an industrial development perspective. Here, a long-running argument is that aid and export credits to individual countries (rather than groups of countries in a region) undermines regional standardisation of machinery and hence the development of a regional industry that could

eventually supply cheaper and more adequate machinery (Östergaard 1989).

4.5 The overlooked politics

Despite the perceived failure of previous state-led mechanisation, this route continues to be pursued by many African governments, with a return to tractorisation notwithstanding its historical record. But this is not without its logic. Mechanisation programmes offer opportunities to extract rents and nurture patron–client relations, as is visible in Zimbabwe where tractor distribution has been connected to political campaigning (Scoones 2016).

Besides being used for mobilising political support, mechanisation can also serve higher-level political purposes, as discussed by Anthony (1988) in her book on the politics of mechanisation and technology transfers in Africa. Tractors were instrumental in Kenya in the 1960s, where President Kenyatta used them for strengthening his political constituency and securing the loyalty of his clan and of a relatively narrow political elite. They were also a tool of the social revolution of villagisation (*ujamaa*) in Tanzania, where President Julius Nyerere expected tractors to help with integrating peasants into modern agricultural production systems. In his own words:

If we want to develop, we have no choice but to bring both our way of living and our way of farming up to date. The hand-hoe will not bring us the things we need today. Very often it has not even sufficed to bring us enough to eat. We have got to begin using the plough and tractor instead. But our people do not have enough money, and nor has the Government, to provide each family with a tractor. So what we must do is try and make it possible for groups of farmers to get together and share the cost and the use of a tractor between them. But we cannot even do this if our people are going to continue to live scattered over a wide area, far apart from each other. The first and absolutely essential thing to do, therefore, if we want to be able to start using tractors for cultivation, is to begin living in proper villages. (President Nyerere, cited by Anthony 1988: 48–49)

Anthony further highlights how practical considerations about harnessing political support were connected with ideas and ideals about modernisation and agrarian change, at a time of post-colonial nation-building. She narrates how an FAO technical mission in Tanzania in the mid-1970s, tasked to assess the

tractorisaton programme and find a solution to a “desert of 3,000 unrepaired and inoperable tractors,” came to realise that tractors were not just pieces of machinery but were “agents of economic and social modernisation” with the capacity to mobilise people in the pursuit of an agricultural development vision (Anthony 1988: 76–77). The mission therefore concluded that economic theory and cost-benefit analyses did not account for mechanisation as a project of social and political transformation. In fact, although conscious of the challenges to the tractorisation programme, the government was committed to take it forward as tractors had become the symbol of peasant farming under the *ujamaa* vision.

The symbolic power of the tractor has been central to modernisation visions that have over the years served different political and social projects across countries. During the Chinese Cultural Revolution, tractors were notable propaganda objects that represented the ideal of building a modern and prosperous countryside. In her study about the intersections of agricultural technology and politics in Mao’s China, Schmalzer (2016: 8) notes:

Of all efforts to modernize agriculture, mechanisation stood in first place for Mao. Mechanization provided the material basis for revolutionary social reorganization: adoption of tractors would enable larger field sizes, and so the transition from family farming to communal agriculture.

Similarly today, tractors continue to be political and symbols of modernity (Scoones 2016). They are also an instrument of agrarian change, as the analysis by Amanor (forthcoming) in Ghana well demonstrates. As suggested by a Mozambican government official, they can assist the transition from subsistence family farming into modern commercial farming (Cabral et al. 2016).

Agricultural mechanisation in Africa today continues to be a case study, therefore, of competing perspectives on agricultural development in the literature. Scholars from different academic backgrounds (including engineering, economics, politics and agrarian studies) often disagree on the purpose and effects of mechanisation. The three country studies in Ghana, Mozambique and Zimbabwe (Amanor forthcoming; Cabral 2019; Shonhe 2019) that complete the APRA collection on mechanisation highlight the complex functioning of state policy and agrarian relations that drive and shape mechanisation. These are overlooked by studies solely concerned with the economic rationale of technology adoption.

5. MECHANISATION IN THE NEW INTERNATIONAL DEVELOPMENT LANDSCAPE

Agricultural mechanisation can also be taken as a lens through which to examine the disputes around ideas and markets in the changing landscape of international development. In this section, the paper considers specifically the role of FAO as a leading knowledge broker on agricultural policy and advocate for mechanisation in Africa. It then examines the claim of 'Southern solutions to Southern problems' made by countries like Brazil, India and China, and the response by Northern corporations and aid agencies.

5.1 FAO's advocacy on Africa's mechanisation

FAO has been a leading advocate of agricultural mechanisation in Africa since the days of the post-Independence enthusiasm about the role of agriculture in nation-building. Anthony (1988) documents that, back then, FAO's institutional preference for mechanisation sometimes undermined a neutral assessment of appropriate solutions. It supported the Tanzanian government's pro-tractor policy, in the 1970s, in the face of evidence that tractors were not suitable for the country's circumstances. It put considerable effort into mobilising support for large-scale modernisation and tractors, despite the lack of repair and maintenance services or evidence that animal draft technology would be more adequate for peasant agriculture to move beyond hand hoe cultivation. Unable to persuade donor agencies to finance the revival of the failing tractorisation programme, FAO turned to the private sector and the multinational corporations that sold tractors (such as Fiat, Ford, Massey-Fergusson, John Deere and Caterpillar) for the provision of training, repair and maintenance services. The initiative only had limited success as the conditions were not attractive for business investment – largely because of the looming threat of nationalisation of private operations by the Tanzanian socialist regime (ibid). Yet, the emphasis on the role of private providers and market development, not least to ensure availability of spare parts and repair services, was a feature of FAO's mechanisation vision. Another feature of FAO's approach was the emphasis on the technical leadership of the Ministry of Agriculture, reflecting a view that states have a role

in guiding development of creating the conditions for an enabling market.

FAO's narrative on Africa's mechanisation continues to advocate for market solutions (Mrema et al. 2008), while emphasising a strategic role for the public sector. The state should therefore strengthen the regulatory framework (to create an enabling business environment), stimulate demand (for example, through subsidies and training) and promote particular types of technological solutions – the FAO policy guidelines for SSA governments illustrates this dimension (Houmy et al. 2013). The recently launched Sustainable Agricultural Mechanization for Africa (SAMA) strategy puts particular stress on the role of the private sector in leading the supply of machinery, the provision of hardware services and the development of innovative business models (FAO and AUC 2018).

In addition, mechanisation guidance is now shaped by concerns for development sustainability, which gives equal weight to the social and environmental dimensions and impacts of mechanisation, as well as economic efficiency. FAO's narrative therefore emphasises sustainability and the need to promote mechanical solutions that are suitable and affordable for small farmers, and are compatible with the preservation and enhancing of natural resources and the environment (FAO 2016a, 2017). It is argued that private provision should be developmentally responsible⁹ and offer solutions that are suitable for small farms and the environment (Sims, Hilmi and Kienzie 2016). Markets should therefore be guided to supply small-scale mechanical solutions and machinery compatible with conservation agriculture, such as implements that produce minimum soil disturbance (Baudron et al. 2015; Sims and Kienzie 2015b).

Whilst there is a relatively widespread consensus among the most influential international sources of finance and policy guidelines on mechanisation (including FAO, the World Bank, African Development Bank, United Nations Industrial Development Organization and IFPRI) that the state should focus on the regulatory environment and refrain from directly

intervening in technology selection and procurement, there is less agreement on whether particular types of machinery should be promoted. Indeed, FAO's call for market-based solutions sits uneasily with its advocacy for specific kinds of small-scale technology compatible with conservation agriculture.

FAO's advocacy for small-scale, appropriate, and conservation agriculture-compatible technology contrasts with the type of vision expressed by a World Bank official:

There is a rapid advancement in the design of agricultural machines that our fields could be tilled, sown, tended and harvested entirely by fleets of cooperating autonomous machines by land and air. This could allow machines working day and night. (FAO 2016b: 3)

There are also different views on where the best sources for suitable and affordable technology for the African context are located. The North-versus-South distinction often comes up, set in the context of global competition for markets and influence.

5.2 Southern solutions to Southern problems

China, India and Brazil, among other countries from the global South, have in recent years engaged in selling farming machinery in African markets. The supply of machines by these Southern powers is set within the framework of South-South relations that combines commercial motivations with diplomacy and cooperation, and often emphasises their relative affinity and proximity (in contrast to the North) – both in terms of farming conditions and stages of agricultural and technological development. Hence, this framework highlights the South-South transfer of suitable development models, experiences and technology.

The Indian government, for example, has noted:

The need for technology cooperation between the countries of the South was felt early on because direct application of technologies developed in the West may not be appropriate for developing countries as they face complex challenges. On the other hand, the technology gap between the Southern countries is smaller. In this regard, Indian technology may be more suited to the needs of African countries (...) India-Africa science and technology cooperation offers a unique opportunity for agricultural growth in Africa. The case for greater

agricultural cooperation between India and Africa is stronger because of the similar agro-climatic conditions in India and Africa. (Ministry of External Affairs (Government of India) 2015: 2–5)

The Brazil government has not only emphasised physical similarities but also cultural proximity, an idea rooted in a common colonial past and the slave-trade link. These claims about affinities are reinforced by arguments that machinery produced in these countries is better suited for conditions across much of Africa – being simpler, robust (to endure tropical soils and climatic conditions) and affordable. For Brazil, the claim that its technology is fit for tropical latitudes has long been deployed in business relations with the continent. Dávila (2010) describes the trading of Brazilian home appliances in Nigeria in the 1970s and how their marketing strategy emphasised suitability to local conditions:

[The Brazilian ambassador to Nigeria] explained that Brazilian industrial products “are specially qualified for Nigeria because they have designs and specifications that are adapted to the tropical market.” In particular, they were supposedly simpler and more rugged, more resistant to voltage fluctuations and humidity, and easier to repair. (Dávila, 2010: 221)

Not all Southern solutions are the same. While China seems unbeatable on affordability, others try to compensate with claims of superior quality of services. Brazilian manufacturers, for example, made good use of the MFI cooperation programme to assert the added value of their product. Rather than a conventional machinery export operation, MFI was initially presented as an example of Brazil's responsible approach to business, particularly towards Africa (Cabral 2016b). It promised the extras of post-sale services, technical cooperation and policy exchange, which were described as contributions to Africa's development process, but which failed nonetheless to materialise. As discussed elsewhere, leaving the issue of affordability aside, the claim of superior suitability and the appropriateness of Southern technology has been to a large extent a marketing gimmick that echoes the discourse of South-South affinity (Cabral 2016a).

5.3 Northern corporations with 'sustainable' solutions

The global agricultural machinery industry is dominated by European and North American producers, which in 2012 accounted for more than half of the world's

production, valued at over US\$100 billion (Scherer 2013). China comes third in the ranking and its share of the global market has been growing steadily over recent years (ibid).

European manufacturers, facing growing competition from China and declining demand for their products in the European market, have become increasingly interested in the African market, as recent initiatives by the European Committee of Associations of Manufacturers of Agricultural Machinery (CEMA^v) illustrate (CEMA 2014, 2017c). This is happening after years of neglect of African agriculture that accompanied the withdrawal of the state and aid from the sector across much of the continent. In 2016, CEMA joined the African Union, FAO, the World Bank, the Alliance for a Green Revolution in Africa (AGRA) and others in Addis Ababa, for the 'Consultative Meeting on a Mechanization Strategy' for SSA. In early 2017, it hosted the Africa Summit on agricultural mechanisation as a parallel event to SIMA's international agribusiness fair in Paris. At these events, CEMA put forward a sustainable mechanisation agenda that claimed to offer tailored and inclusive solutions cutting across different farming systems and sizes, and following an integrated approach centred on value chains and partnering with governments (CEMA 2017b). Yet, it demanded more attractive conditions for investment, in order to deliver its agricultural development agenda. For example, CEMA (2014) called on the European Union, the United Nations and financing institutions like the World Bank, IFAD and the African Development Bank to support governments in developing mechanisation strategies, removing barriers for market development and partnering with the private sector for machinery supply.

In order to exert the full potential of agricultural mechanization in developing countries the public and the private sector need work together to nurture an adequate enabling environment that allows the largely self-sustaining private sector (consisting of manufacturers, distributors and dealers, and service providers) to develop and operate effectively. (CEMA 2017a: 5)

CEMA's partnership with FAO to promote sustainable agricultural mechanisation in developing countries (Sims et al. 2016) put a development stamp onto the industry's commercial intent. However, it is not entirely clear how CEMA interprets sustainability, nor whether its strategy for Africa is aligned with FAO's prioritisation of small farmers and soil conservation prerogative. CEMA emphasises the quality and range

of technology that European manufacturers can offer and talks about inclusiveness as solutions for all farm types and sizes.

CEMA representatives have also questioned the assertions that technology from countries like Brazil, India or China may be more suitable to local conditions – they may be more affordable, CEMA concede, but not necessarily technically appropriate, nor of the same quality.^{vii} In making the case for the European contribution to Africa's sustainable mechanisation, Brazil, China and India are illustrated as examples of countries with low mechanisation levels, rather than competing technology providers (CEMA 2017a). FAO, by contrast, has pointed towards India, China and Brazil as new sources for agricultural machinery that offer more economical and less sophisticated versions of machinery, which may be more suitable to and affordable for African smallholders in particular (Sims et al. 2016). Yet, machines produced by Northern corporations in Southern countries, like India and Brazil, are singled out as being particularly solid, cheaper and better adapted to the SSA market (ibid).

Meanwhile, the American company AGCO (formerly known as Allis-Gleaner Corporation)^{viii} has developed a starter machinery kit for small-scale farmers in SSA, which comprises a small tractor and tractor implements. The small tractor is Massey Ferguson's revamped MF 35 model (36 HP), which is being marketed across Africa as the 'people's tractor', putting 'tractor power within everyone's reach' and bringing mechanisation to a new generation of farmers, farm workers and emerging agribusinesses. The company claims: '[The MF 35] is very durable and, at the top of the list, it's aimed at low cost of ownership, so it really is the tractor for Africa' (Massey Ferguson 2015).

AGCO's starter kit for small farmers and solutions for medium- and large-scale farmers are being piloted through the Future Farm initiative, presented as the main channel for promoting the sustainable mechanisation strategy for Africa.

The AGCO Future Farm's vision is to develop a sustainable food production system that is able to increase farm output by utilizing agricultural resources more efficiently. Recognizing Africa's tremendous growth potential in agriculture, the AGCO Future Farm has already planted firm roots in Zambia and is a key component of AGCO's commitment to being Africa's partner for development. (Massey Ferguson 2016)

A 150 ha model farm was set up in Zambia in 2012 to demonstrate the use of 'the latest' machinery and offer training (AGCO 2012). The demonstration farm in Zambia targets all types of producers from smallholders to large commercial farmers.

Small to medium scale farmers with limited access to modern farming will benefit from training courses ranging from basic agronomy to general mechanization. Large scale farmers will be offered training on high specification tractors and harvesting equipment, including precision farming technology. (AGCO 2012: 2)

The initiative is currently being extended to Senegal and there are plans to spread more widely across the continent (Aderibigbe 2014). The Future Farm initiative is not just about mechanisation but it unleashes other commercial opportunities for international corporations. Bayer is now a partner of AGCO in the initiative covering aspects related to pest, weed and

disease management (Bayer 2015). Other companies, including Yara, have also been brought on board (Aderibigbe 2014). These mechanisation initiatives therefore have a broader reach across the agri-food industry, with implications in terms of favoured pathways for agricultural development.

Overall, agricultural mechanisation in Africa has again become an attractive agenda for the private sector and the international development community for interested parties across both the North and South. In the competition for markets and ideas, narratives about sustainable mechanisation, market vs. state-driven mechanisation, and of suitable technology from North or South have been deployed. Questions remained, however, as to whether the forms of mechanisation pushed by the industry, donors and national governments can deliver on development objectives, and how they impact on the ongoing transformation of agrarian societies.

6 CONCLUSION

Agricultural mechanisation and tractors are back on the agricultural agenda in Africa and old debates on the type of mechanisation needed and on suitable policies (and role for the state) to deliver it have been revived. Yet, mechanisation and its disputes are now set in a new context, in terms of development framings, and in terms of alliances between development cooperation and business. Rather than assessing the adequacy of past and present agricultural mechanisation policies in Africa, this paper sought to highlight the contentious nature of the debate and the competing perspectives and interests underpinning narratives about appropriate, Southern, sustainable or farmer-friendly technology.

The paper also emphasised the missing *politics* in much of the academic literature and policy guidance on mechanisation. Dismissing the pursuit of tractorisation by national states as technically misinformed, corrupt and doomed to failure risks neglecting the broader role technology plays as a political instrument beyond its more immediate technical attributes. Back in the 1970s in Tanzania, FAO officials came to recognise that tractors were not just pieces of machinery, but agents of social and political transformation. Similarly, Wuyts (1981: 1) noted that:

The question of choice of technique in agriculture is not merely a technical issue, but principally a political choice which affects the whole social structure of the rural economy.

The political significance of tractors and the multifaceted logic of mechanisation policy become evident when looking at individual countries' experiences. The APRA policy studies in Ghana, Mozambique and Zimbabwe illustrate the interplay between tractors, government politics, agrarian structures and long-term processes of accumulation, nurtured, not least, by development assistance. In Ghana, the dynamism in private machinery markets that has been observed in recent years needs to be considered as part of the long process of agrarian change, and cannot be disconnected from previous state-subsidised land clearing that rendered current investments in technology by farmers relatively cheap (Amanor forthcoming). In Mozambique, tractors have been deployed by the state to nurture a modern agribusiness entrepreneur that fits the state's modernisation ambition, and to feed the ongoing process of accumulation from above in the countryside. But tractors may also be supporting accumulation from below, by emergent small- to medium-scale farmers (Cabral 2019). In Zimbabwe, the land reform process has given rise to medium-scale farmers who have been the main beneficiaries of patronage but are also investing in agricultural mechanisation and production, and are providing services to small-scale farmers (Shonhe 2019). All these are significant but complex dynamics that tend to be disregarded by agricultural development analysts and practitioners, pressed by the urge to find the right technical fix.

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ENDNOTES

ⁱLidia Cabral, Research Fellow, Institute of Development Studies.

ⁱⁱ The FAOSTAT series on mechanisation stopped being compiled in 2008 reflecting, as argued by Biggs and Justice (2015), the reduced interest in the topic since the mid-1990. Unfortunately, no alternative series on agricultural machinery imports in Africa was readily available for this study.

ⁱⁱⁱ Binswanger (1986) and Mrema, Baker and Kahan (2008) provide overviews of these studies.

^{iv} Studying the impact of state-subsidised tractors in Brazil in the 1970s, Sanders & Ruttan (1978) confirmed this by finding that large farms expanded in the South and Central West (the Cerrado region) at the expense of small farmers in poorer Northeast region.

^v Interview with FAO official (Paris, February 2017).

^{vi} CEMA represents an industry that includes 4,500 European manufacturers of agricultural machinery and equipment.

^{vii} Participant observation at African Summit in Paris (28/02/2017).

^{viii} This large agricultural machinery manufacturer supplies top brands as: Challenger, Fendt, Massey Ferguson and Valtra.

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